III. "A Record of Experiments illustrative of the Symptomatology and Degenerations following Lesions of the Cerebellum and its Peduncles and related Structures in Monkeys." By DAVID FERRIER, M.D., F.R.S., Professor of Neuropathology, and W. ALDREN TURNER, M.D., Demonstrator of Neuropathology, King's College, London. Received November 30, 1893.

(From the Neuropathological Laboratory, King's College, London.)

(Abstract.)

This paper is the detailed record of the symptoms, temporary and permanent, following total and partial extirpation of the cerebellum, and section of its peduncles, and the degenerations so induced; and includes the effects of destruction of the tubercles on the posterior surface of the medulla oblongata, and the degenerations resulting therefrom, together with some observations on the central relations of the 5th cranial nerve. The paper is illustrated by photographs taken direct from the microscopical sections. Special reference is made to the similar researches of Luciani and Marchi.

The most noteworthy features of complete extirpation of the cerebellum were the extraordinary disturbances of station and locomotion, and the long-continued and apparently persistent unsteadiness of the trunk and limbs on muscular effort. There were noted, also, from the first, absence of tonic flexion or contracture of the limbs; retention of great and, apparently, unimpaired muscular strength, as evidenced by the firmness of the grasp of the hands and feet, and the agility in climbing; and the presence, with ultimate exaggeration, of the knee-jerks. There was no impairment of the general or special sensibility, or disturbance of the organic functions.

The symptoms observed after extirpation of a lateral lobe, after the first tumultuous disturbance of equilibrium had passed off, were similar to those observed after complete extirpation, with the important difference that they were confined to the limbs on the side of lesion. Except in one case, where it was only present to a slight extent, there was no impulsive tendency to rotation.

Extirpation of the middle lobe, including antero-posterior division, produced, in general, the same symptoms as were observed in connexion with removal of the whole organ and of the lateral lobe, but they did not affect one side more than the other, and were more pronounced in the head and trunk than in the limbs.

The symptoms following section of the cerebellar peduncles were similar to those occurring after removal of the lateral lobe, the chief

difference being the greater tendency to roll round the longitudinal axis towards the side of lesion, whichever peduncle was cut.

Destruction of the clavate and cuneate nuclei caused temporary disturbances of attitude and gait, but there was no affection of cutaneous sensibility.

The degenerations following removal of the lateral lobe of the cerebellum, or section of the superior peduncle, showed that this structure contains an efferent tract to the opposite red nucleus and optic thalamus, and an afferent tract, which appears to be the cerebellar termination of the antero-lateral ascending tract of Gowers.

Lateral lobe extirpation, or section of the middle peduncle, was followed by diminution of the transverse fibres of the pons Varolii on the side of the lesion, and atrophy of the cells of the nucleus pontis on the opposite side.

Lateral lobe extirpation, or section of the inferior peduncle, demonstrated the existence of an efferent tract to the opposite inferior olivary body, and of an afferent tract to the cortex, chiefly of the lateral lobe.

Extirpation of the middle lobe occasioned no degeneration in the superior, middle, or inferior cerebellar peduncles, but was followed by degeneration and sclerosis of the tract which passes from the vermiform process to Deiters' nucleus—the "direct sensory cerebellar tract" of Edinger.

We were unable to confirm Marchi's statements as to the existence of a direct efferent cerebellar tract in the spinal cord, or of degeneration in the anterior nerve roots, mesial fillet, or posterior longitudinal bundles, after cerebellar extirpation.

In two cases of lateral lobe extirpation, however, we obtained degeneration in the anterior and lateral columns of the spinal cord respectively, in the position indicated by Marchi. In the case, however, in which there was a marginal degeneration in the anterior column, the nucleus of Deiters, on the same side, was implicated; while, in that in which degeneration in the lateral column was present, there was a lesion of the tegment of the pons, involving the nucleus of the lateral fillet. The same degeneration was induced by lesions specially made in the lateral fillet.

Destruction of the clavate and cuneate nuclei was followed by degeneration, on the one hand, through the restiform body into the cerebellum; and, on the other hand, through the internal and middle arcuate fibres to the opposite interolivary layer and mesial fillet. This latter structure was traced to the anterior quadrigeminal bodies and optic thalamus.

Owing to lesion in some of the experiments of the roots of the 5th cranial nerve, we were led to make special investigations on its cen-

tral connexions. Degeneration and sclerosis of the so-called "ascending root" was traced as far as the 2nd cervical nerve, after section of the sensory division; and atrophy of the so-called "descending root" was observed after section of the motor division.

We were unable to confirm the existence of a direct cerebellar root to this nerve.

IV. "On the Relations of the Nucleus to Spore-formation in certain Liver-worts." By J. Bretland Farmer, M.A., Royal College of Science, London. Communicated by Professor Vines, F.R.S. Received November 9, 1893.

It is well known that, as a general rule, during the formation of spore tetrads from their mother cells, the nucleus of the latter commonly undergoes two successive bipartitions. Each of the resulting four nuclei ultimately becomes a centre for the aggregation of a portion of the original protoplasm, whilst division of the whole immediately follows by means of cell walls.

Though the above method is the one most commonly followed during the process of spore development, so far as the essential features are concerned, it is by no means the invariable one. Probably, however, it is to be regarded as typical, and the deviations about to be described should be interpreted as modifications of it.

Anyone who is familiar with Hofmeister's drawings, or who has ever seen spore production actually going on in the Hepaticæ, must have noticed that, in many species, the mother cell of the tetrad becomes four-lobed previously to its breaking up into its four spores. This lobed appearance is seen whilst the original nucleus is still resting, and is due to a bulging out of the cell wall in four directions, accompanied by an ingrowth of cellulose into the lumen of the cell, and towards the nucleus.

If the process be followed in *Aneura multifida*, the intruding walls are seen to closely approach the nucleus while this body is still in the resting state. The latter body then divides very rapidly, forming first ten, then twenty, chromosomes, which are arrayed along a very short spindle at the centre of the cell. Then another spindle appears in a plane inclined to that of the first, and the number of the chromosomes is apparently about forty, though, by reason of their small size and the difference in their planes, it is difficult to be quite certain as to their number. The nucleus here then goes through the ordinary form of karyokinesis, but in a somewhat compressed form. The four groups of ten chromosomes then move off along the achromatic spindles to their respective lobes, and the further ingrowth of the cell walls to the centre, where they meet, cuts off the several proto-